Osmotic concentration and habitat.—The influence of habitat and environmental conditions upon the sap concentration of leaf cells has received considerable attention recently from HARRIS and his co-workers. The cryoscopic method has been used in all determinations of the concentration of tissue fluids, and the studies have now become sufficiently extensive to permit comparisons between the average conditions found in plants of different regions. The mangrove vegetation of Jamaica and Florida[11] has been examined with reference to the influence of salinity of soil water on leaf sap concentration. Three species belonging to three different families were used. The sap concentration is high in all of them, 25–50 atmospheres. *Avicennia nitida* develops the highest concentration of the three, but shows the least variation with environment. *Rhizophora mangle* gave freezing point depressions equivalent to 22–30 atmospheres, and showed distinctly lower leaf sap concentration in fresh water habitats. *Laguncularia racemosa* responded most noticeably, with about 20 atmospheres in fresh water, 25 atmospheres in normal sea water, and 33 atmospheres on sterile mud flats where the sea water is concentrated by evaporation.

A similar study has been made of the Jamaican Blue Mountain rain forest vegetation,[12] where the rainfall averages from 100–130 inches per year. Only terrestrial plants have been reported upon so far, coming from four distinct sub-habitats: the ruinate of leeward slopes, leeward ravines, ridges, and windward slopes and ravines. The plants of each habitat are grouped as ligneous and herbaceous. Distinct differences in the concentration of the tissue fluids of plants growing in each habitat were found, and, as in previous work, the ligneous plants of each type habitat proved to have more concentrated leaf sap than the herbaceous group. The average osmotic concentration of the ligneous plants is about 11.44 atmospheres, and of herbaceous plants 8.8 atmospheres. These figures are lower than for any region thus far investigated, and contrast strongly with values obtained from our southwestern deserts, where herbaceous plants reach 15 atmospheres and ligneous plants 25. In ascending order of sap concentration, the four sub-habitats stand as follows: the windward slopes and ravines, leeward ravines, ridge forests, and ruinate.

Variation in leaf sap concentration with height of insertion on the tree[13] has been studied also, and DIXON'S results confirmed, that the concentration of sap is almost always higher, the higher up the leaf is on the tree. Since, however, the specific electrical conductivity of the sap usually decreases from lower to higher levels, it is probable that photosynthetic sugars are produced

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[11] HARRIS, J. ARTHUR, and LAWRENCE, JOHN V., The osmotic concentration of the sap of the leaves of mangrove trees. Biol. Bull. **32**:202–211. 1917.

[12] ———, The osmotic concentration of the tissue fluids of Jamaican montane rain forest vegetation. Amer. Jour. Bot. **4**:268–298. 1917.

[13] HARRIS, J. ARTHUR, GORTNER, ROSS AIKEN, and LAWRENCE, JOHN V., The relationship between the osmotic concentration of leaf sap and height of leaf insertion in trees. Bull. Torr. Bot. Club **44**:267–286. 1917.

more abundantly in the upper parts of the trees, and are the cause of increased sap concentration. Any agreement between observed increments of osmotic pressure and theoretical values calculated from the increased hydrostatic head and resistance to be overcome in the tracheae by virtue of higher position is regarded as a coincidence, and not as a proof of adjustment on the part of the cells to the back pull of increased head and resistance.—CHARLES A. SHULL.

Antagonism.—Antagonism between iron and manganese in their effects on the growth of two varieties of wheat has been investigated by TOTTINGHAM and BECK.[14] Manganous chloride in water cultures even in low concentrations reduces root growth, but when ferric chloride is added in about equimolecular (0.00001M) concentration the deleterious effects of the manganous salt are overcome. The two varieties of wheat used did not give exactly the same results, and it is believed that effects will depend on variety to a certain extent. Thus the amount of reserve iron in the seed would influence the response of the plant to variations in supply of salts of these two metals. In very dilute solutions the manganous chloride seemed to have stronger effects than ferric chloride on the color and growth, while in higher concentrations (0.001M) the iron salt had more effect than the manganese. Although the concentrations used approach that of these salts in the soil solution, no conclusions as to antagonism in soil cultures can be drawn because of the great variety of other salts and conditions which might modify the result.

SKINNER[15] has studied the effects of manganese sulphate and some other inorganic substances in overcoming the unfavorable action of vanillin and salicylic aldehyde on plants grown in culture solutions of varying composition. He finds that vanillin reduces the growth of cow peas, but the presence of nitrate reduces the unfavorable action, and may even entirely overcome the reduction of growth caused by vanillin. The harmful effects of salicylic aldehyde in 5 and 10 ppm. concentrations on wheat seedlings were entirely overcome by manganese sulphate in 10 ppm. concentration; and the harmfulness of vanillin was also partially overcome by manganese sulphate. He explains the action of nitrate and manganese on the ground that they favor root oxidation, whereby the harmful organic compounds are oxidized and are not permitted to influence growth unfavorably.—CHARLES A. SHULL.

The embryo sac of Aster and Solidago.—These much investigated embryo sacs have been studied again, this time by PALM,[16] a pupil of ROSENBERG.

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[14] TOTTINGHAM, W. E., and BECK, A. J., Antagonism between manganese and iron in the growth of wheat. Plant World **19**:359–370. 1916.

[15] SKINNER, J. J., The effect of vanillin and salicylic aldehyde in culture solution and the action of chemicals in altering their influence. Plant World **19**:371–378. 1916.

[16] PALM, BJ., Zur Embryologie der Gattungen *Aster* und *Solidago*. Acta Horti Bergiani **5**:1–18. *figs.* 27. 1914.